REMARKS

The Office Action dated February 18, 2004 has been reviewed carefully and the application has been amended in a sincere effort to place the application in condition for allowance.

Objection to the Drawings

The drawings were objected to based upon a number of informalities. With respect to those informalities mentioned in paragraph 3 of the Office Action, we have the following comments. Reference characters 24 and 32 have been removed from Fig. 1. Reference character 16 was removed from Fig. 1A. Reference character 5 is mentioned in the Specification at page 8, line 16 and it appears in Fig. 1, and it designates the housing of the fuel cell. Reference character 40 has been changed to 34 in Fig. 4, and it represents the flow field 34, which is mentioned in the Specification at page 11, lines 20 and 21. The Specification has been amended to refer to reference character 61 as "one side of the anode chamber," as illustrated in Figs. 6A and 6B (Specification page 14, line 19). Reference characters 848 and 849 are illustrated in Fig. 8 and the Specification has been amended to include a reference to those items at page 16, line 8. The Specification has been amended to mention reference character 930 (Fig. 9) at page 16, line 28. The Specification has also been amended to include a reference to gas separator 31, and reference character 30 in Fig. 1 has been changed to 31 accordingly.

The catalyst 11 is illustrated in Fig. 3 and the typographical error in the Specification regarding this item has been corrected at page 9, line 3.

The reference character 740 was erroneously repeated twice in Fig. 7B and the figure is being corrected to conform to Fig. 7A in which the methanol conduit is item 710 and the single conduit is item 740, as described in the Specification.

Proposed drawing corrections with the proposed changes marked in red are included herewith for review by the Examiner.

Objection to the Specification

The references to co-pending United States patent applications have been updated with respect to the current status thereof.

Applicants have reviewed the Specification and, where appropriate, have capitalized any trademarks.

With respect to the abstract, Applicants have made amendments to maintain the abstract within the range of 50 to 150 words.

Claim Objections

Claim 37 was objected to based on an informal matter. More specifically, the second appearance of the limitation "an anode chamber" has been amended to refer to "said anode chamber."

Claim 38 was objected to on the basis that the limitation "said liquid-closed volume" does not have proper antecedent basis. Thus, the limitation has been amended to read "a liquid-closed volume."

Claim Rejections - 35 U.S.C. § 112

Claim 42 was rejected under 35 U.S.C. § 112 on the basis that it lacks dependency. This was due to a typographical error and the claim has been amended to indicate that claim 42 depends upon claim 37.

Claim Rejections - 35 U.S.C. § 102

Claims 37-46, 55-58, 62, 63, 65, 66 and 68-73 were rejected under 35 U.S.C § 102(e) as being anticipated by Corey *et al.*, United States Patent Published Application No.: US 2002/0172851.

Briefly, Applicants' invention is a simplified direct oxidation fuel cell system in which CO2 gas generated in the anodic reaction is vented substantially directly to the ambient environment, without the need for pumping or valving the CO2 to other portions of the fuel cell system. The CO2 is directly vented out of the system in order to prevent the accumulation of CO2 and corresponding buildup of pressure in the anode chamber, each of which may hinder the operation of the fuel cell system. In another embodiment of the invention, a gas permeable layer is disposed in close proximity to the anode diffusion layer to further assist in the removal of CO2 gas generated in the anodic reaction.

This arrangement in turn obviates the need to recirculate unreacted fuel back into the fuel cell system thereby minimizing or eliminating the need for pumps, valves and other recirculation devices. (Specification page 5, lines 14-24). In addition, Applicant's venting of the CO2 out of the system assists in efficient fuel management and delivery. This improves operation of the fuel cell system, generally, and leads to simpler operation

The Corey system, on the other hand, is specifically directed to using anodically generated CO2 to remove water from the cathode aspect of the fuel cell. As such, Corey requires that the anodically-generated CO2 be routed through the cathode chamber, and not directly to the ambient environment. This is quite different from Applicants' invention, and the problem that Applicants' invention addresses. Stated differently, the invention set forth in Corey is aimed at effecting the removal of cathodically generated water from the cathode aspect of the fuel cell, whereas the present invention describes a fuel cell system with the means to provide direct removal of anodically generated CO2 so that it does not adversely affect the overall operation of the fuel cell system .

The Corey reference cited by the Examiner teaches water removal from the cathode chamber using CO2, and it requires the use of a subsystem comprised of at least a dedicated fluidic component, such as a conduit, between the anode and the cathode aspects of the fuel cell system. More particularly, the Corey reference teaches a water management system and method using an effluent gas (carbon dioxide) gener-

ated as a byproduct of the fuel oxidation to remove or recirculate water from the cathode aspect of the fuel cell system (Column 2, Section 16).

As stated by Corey, and as quoted by the Examiner, in Corey, "Carbon dioxide produced from the oxidation of fuel is not directly exhausted from the fuel cell system but instead, is used to remove/recirculate effluent water" (Corey, Section 0017). As noted, this use of the anode effluent is quite different from the claimed invention. The effluent gas produced in the anode chamber of the fuel cell of Corey is collected and then exhausted <u>through the cathode chamber</u> of the fuel cell in order to remove water from the cathode chamber. Valves control the flow of carbon dioxide gas from the anode chamber into the cathode chamber. In another embodiment, a nozzle is disposed between the anode chamber and the cathode chamber to deliver effluent gas produced in the anode chamber into the cathode chamber via the nozzle. In that embodiment, a mixture of air, water and carbon dioxide is then outported <u>from the cathode chamber</u> to the environment or to other portions of the fuel cell system.

In all of the embodiments described by Corey, at least a portion of the carbon dioxide is delivered into the cathode chamber and is outported from the fuel cell via the cathode chamber. In other words, there is a fluid connection between the anode and the cathode chamber in Corey, which fluid connection is used to direct anodically generated carbon dioxide through the cathode chamber in order to eliminate or manage the water in the cathode chamber.

The Examiner mentions that Fig. 5 of Corey represents a passive fuel cell system that operates without external pumping of cathodically generated water and without active water removal elements. The teaching of Corey, however is directed to a subsystem to remove water from the fuel cell system. Applicants respectfully suggest that an active water removal element is included in Corey's Fig. 5, namely the nozzle 66, which drives CO2 from the anode chamber 70 to the cathode chamber 72 in order to remove water. The water, CO2 and air are then piped out through the cathode chamber via the conduit 79. However, even if this arrangement is not considered to be active, the CO2 is still being routed through the cathode chamber, and not directly to the ambient environment.

Applicants' invention is a simplified system that promotes fuel efficiency by venting CO2 substantially directly to the ambient environment, and not through the cathode chamber, and it does not include fluidic communication for delivering anodically-generated CO2 from the anode chamber to the cathode chamber. Thus, the Corey reference, which is directed to managing water by pumping or valving CO2 from the anode chamber into the cathode chamber, cannot be said to anticipate Applicants' invention.

In making the rejection, the Examiner refers a statement in the Background section of Corey (Section 0014) that: "Theoretically, the effluents could be removed by venting the carbon dioxide out of the anode chamber and evaporating the water from the cathode side of the membrane electrolyte with a low humidity ambient air flow.

However, under many relevant conditions (*e.g.*, low volume air flow, low ambient air pressure, moderate to high humidity) the water cannot be effectively removed, and thus, alternate methods of eliminating water generated in the cathode are required".

Corey mentions this in the more limited context of lower humidity conditions in which a cathode chamber could become dry in which case the membrane could be inadequately hydrated. In such a case, the valves of Corey might be used to control the flow of CO2 so that CO2 is prevented from flowing into the cathode chamber until a desired degree of water is maintained within the cathode chamber to promote adequate hydration. In that case it may be desirable to vent some CO2 out of the anode chamber to avoid a build up. In still other cases, excess amounts of CO2 beyond that needed to maintain desired operating conditions, may be vented to the ambient.

Thus, even in view of that statement about more limited circumstances, the teachings of Corey uniformly describe a fuel cell subsystem wherein at least a portion of the CO2 is delivered from the anode chamber to the cathode chamber, in order to provide water management. Specifically, Corey states that: "Carbon dioxide produced from the oxidation of fuel is <u>not directly exhausted from the fuel cell system</u> but instead, used to remove/recirculate effluent water" (Corey, Section 0017). Furthermore, each of the drawings of Corey also illustrates that the CO2 is routed from the anode chamber through the cathode chamber prior to being released to the ambient air, or to another portion of the fuel cell system. Accordingly, it is respectfully submitted that

Corey cannot have anticipated Applicants' invention in which anodically generated effluent is released directly to the ambient environment.

In order to enhance and clarify the distinctions that Applicants' invention has over the prior art reference, independent claim 37 has been amended to include the limitation that the gaseous effluent release port is <u>in substantially direct fluid communication with the ambient environment</u>. In view of this amendment and the arguments presented herein, it is respectfully submitted that the present invention as claimed in claim 37 and the claims dependent therefrom, is distinguishable over the Corey reference.

In addition, claim 55 and the claims dependent therefrom were also similarly rejected as having been anticipated by Corey. However, independent claim 55 requires a gas permeable, liquid impermeable layer coupled to the anode diffusion layer. Nowhere does Corey teach or suggest a gas permeable layer that is coupled to an anode diffusion layer. Corey's gas effluent management system comprises a series of pumps and valves and (a nozzle in the case of the embodiment of Fig. 5) which are not anticipatory of a gas permeable layer located in the anode chamber near the anode diffusion layer. Accordingly, Applicants' independent claim 55, and the claims dependent therefrom, which include an element that is not taught by Corey, cannot be anticipated by the Corey reference.

With respect to claim 62 and the claims dependent therefrom, claim 62 relates to a direct oxidation fuel cell system having a cell housing with an anode chamber defined

between the anode aspect of the catalyzed membrane and one exterior portion of the fuel cell housing with the chamber having no exit port for liquid. An element is disposed between the fuel source and the anode aspect of the direct oxidation fuel cell for controlling the delivery of fuel to the membrane electrolyte. The fuel cell housing has no exit port for liquid. Applicants respectfully submit that this is distinguishable over Corey in that, although Corey suggests an anode supply for liquid into the anode chamber, it does not suggest an exit port for liquid. Applicants respectfully submit that claim 62, and the claims dependent therefrom, thus cannot have been anticipated by Corey.

SUMMARY

All of the objections made by the Examiner regarding informalities in the application have been addressed herein. In addition, claim amendments have been made and arguments have been presented and it is respectfully submitted that based upon the claim amendments and the arguments presented herein, the invention is patentable over the cited reference and the application is now in condition for allowance.

Please do not hesitate to contact the undersigned in order to advance the prosecution of this application in any respect.

Please charge any additional fee occasioned by this paper to our Deposit Account No. 03-1237.

Respectfully submitted,

Rita M. Rooney
Reg. No. 30,585
CESARI AND MCKENNA, LLP
88 Black Falcon Avenue
Boston, MA 02210-2414
(617) 951-2500